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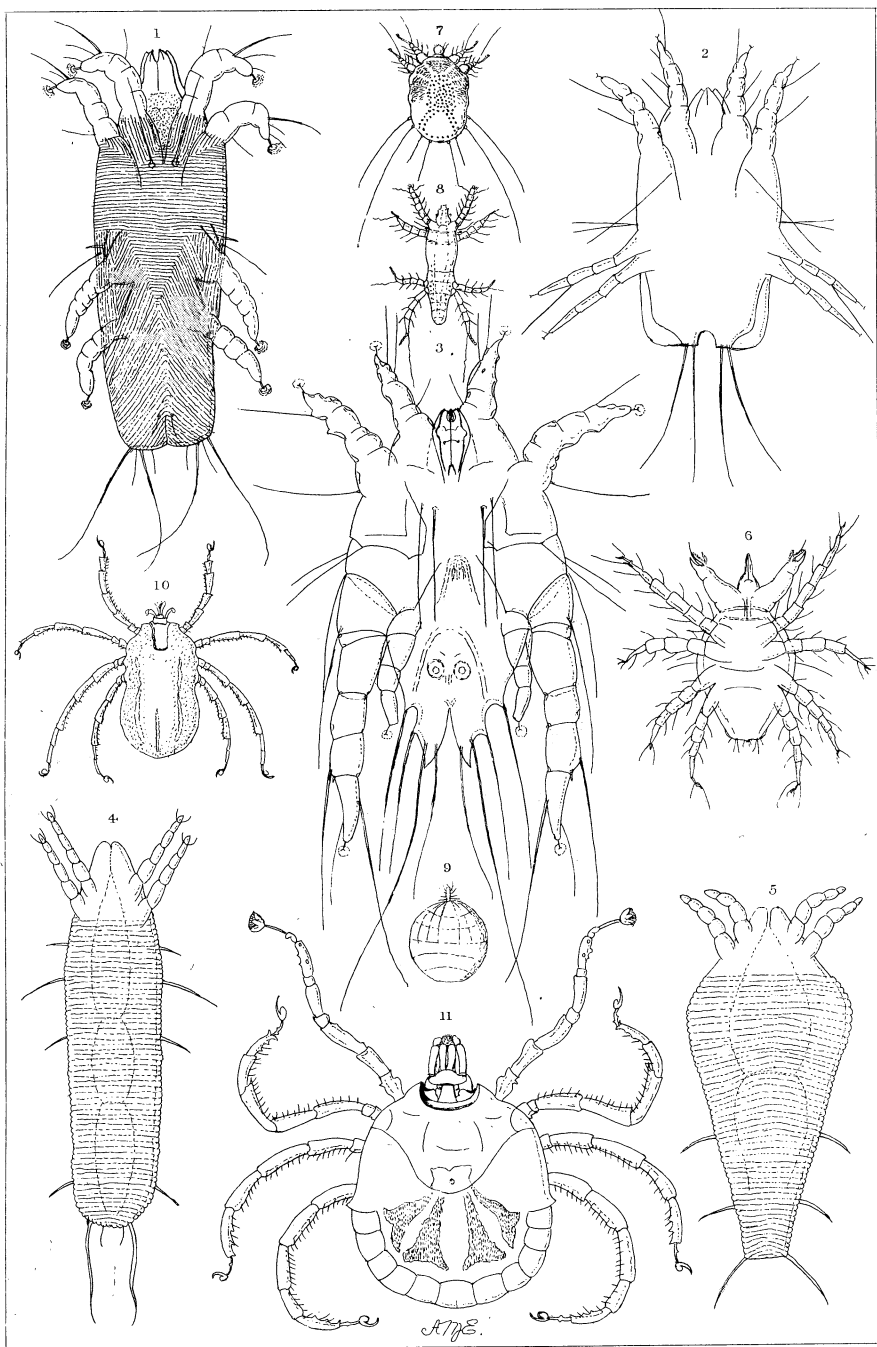
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also, is sometimes used in their holes ; hot ashes, spirits of turpentine, and other articles of the same kind, are useful to turn them from their course. When a live coal is dropped in their way they immediately attack it, though hundreds may perish in doing so. They are very sensitive to the light of the sun, which is fatal to them. They seldom move during the day, and then only during cloudy days, choosing then the dark woods or thick grass. Their rate of progression is about two yards in a minute, and in their journeys from place to place they go from four to eight abreast. I have seen a stream of Drivers crossing an open path at six o'clock in the morning, and at six at night their number was undiminished. How long they had been passing before I saw them, or how long it continued, I am not able to say. Their path, from constant travel, became quite worn and smooth. The natives are very careful to remove all grass from the vicinity of their houses, as a means of keeping off these pests.

A CHAPTER ON MITES.

BY A. S. PACKARD, JR.

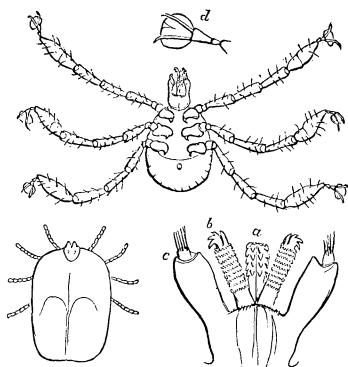
BUT few naturalists have busied themselves with the study of mites. The honored names of Hermann, Von Heyden, Dugés, Dujardin and Pagenstecher, Nicolet, Koch and Robin, lead the small number who have published papers in scientific journals. After these, and except an occasional note by an amateur microscopist who occasionally—not to speak too irreverently—pauses from his “diatomaniacal” studies, and looks upon a mite simply as a “microscopic object,” to be classed in his micrographic Vade Mecum with mounted specimens of sheep’s wool, and the hairs of other quadrupeds, a distorted proboscis of a fly, and podura scales, we read but little of mites and their habits. But few



readers of our natural history text-books learn from their pages any definite facts regarding the affinities of these humble creatures, their organization, and the singular metamorphosis a few have been known to pass through. We shall only attempt in the present article to indicate a few of the typical forms of mites, and sketch, with too slight a knowledge to speak with much authority, an imperfect picture of their appearance and modes of living.

Mites are lowly organized Arachnids. This order of insects is divided into the Spiders, the Scorpions, the Harvestmen and the Mites (Acarina). They have a rounded oval body, without the usual division between the head-thorax and abdomen, observable in spiders; the head, thorax, and abdomen being merged in a single mass. There are four pairs of legs, and the mouth-parts consist, as seen in the adjoining figure of a young tick (Fig. 61, young *Ixodes albipictus* Pack.*), of a pair of maxillæ (c), which in the adult, terminates in a two or three-jointed palpus, or feeler; a pair of mandibles (b), often covered with several rows of fine teeth, and ending in three or four larger hooks, and a serrated labium (a). These parts form a beak which the mite, or tick, insinuates into the flesh of its host, upon the blood of which it subsists. While many of the mites are parasitic on animals, some are known to devour the eggs of insects and other mites, thrusting their beaks into the egg and sucking the contents. We have seen the mite (*Nothrus*) figured on the following page (Fig. 62) busily engaged in destroying the eggs of the Canker worm, and Dr. Shimer has observed the *Acarus? malus* sucking the eggs of the Chinch bug. While

Fig. 61.

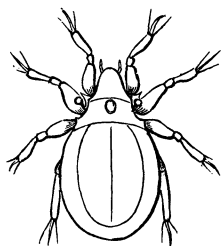


* The figure at the bottom on the left represents the adult, fully-gorged tick.

a few mites are injurious to man, the larger part are beneficial, being either parasitic and baneful to other noxious animals, or more directly useful as scavengers, removing decaying animal and vegetable substances.

The transformations of the mites are interesting to the philosophic zoölogist, since the young of certain forms are

Fig. 62.



remarkably different from the adults, and in reaching the perfect state the mite passes through a metamorphosis more striking than that of many insects. The young on leaving the egg are usually hexapodous, *i. e.*, have six legs, as we have seen in the case of the *Ixodes albipictus* previously noticed in the NATURALIST (Vol. ii, p. 559). Sometimes, however, as in the case of the larva, as we may call it, of a European species, *Typhlodromus pyri* (Pl. 6, fig. 4), the adult of which, according to A. Scheuten, is allied to *Acarus*, and lives under the epidermis of the leaves of the pear, there are but two pairs of legs present, and the body is long, cylindrical and worm-like. Plate 6, fig. 5 represents the four-legged larva of another species of *Typhlodromus*.

We have had the good fortune to observe the different stages of a bird mite, intermediate in its form between the *Acari* and *Sarcoptes*, or Itch-mite. On March 6th, Mr. C. Cooke called my attention to certain little mites (Pl. 6, fig. 1) which were situated on the narrow groove between the main stem of the barb and the outer edge of the barbules of the feathers of the Downy Woodpecker, and subsequently we found the other forms indicated in Plate 6, figs. 2 and 3, in the down under the feathers. These long worm-like mites were evidently the young of the singular *Sarcoptes*-like mite, represented by figs. 2 and 3 of the plate, as they were found on the same specimen of Woodpecker at about the same date, and it is known that the growth of mites is rapid, the metamorphoses occupying but a few days.

The larva (though there is, probably, a still earlier hexapodous stage) of this Sarcoptid has an elongated, oblong, flattened body, with four short legs, provided with a few bristle-like hairs, and ending in a stalked sucker, by aid of which the mite is enabled to walk over smooth, hard surfaces. The body is square at the end, with a slight median indentation, and four long bristles of equal length. They remained motionless in the groove on the barb of the feather, and when removed seemed very inert and sluggish. A succeeding stage of this mite, which may be called the pupal, is represented on Plate 6, fig. 2. It is considerably smaller than the larva (all the figures of this sarcoptid being drawn to one scale by Prof. A. M. Edwards, and magnified 115 diameters), and looks somewhat like the adult, the body having become shorter and broader. It is perhaps the pupa, or nymph. The adult (Pl. 6, fig. 3) is a most singular form, its body being rudely ovate, with the head sunken between the fore legs, which are considerably smaller than the second pair, while the third pair are twice as large as the second pair, and directed backwards, and the fourth pair are very small, not reaching the extremity of the body, which is deeply cleft, and supports four long bristles on each side of the cleft, while other bristles are attached to the legs and body, giving the creature, originally ill-shapen, a haggard, unkempt appearance. The two stigmata, or breathing pores, open near the cleft in the end of the body, and the external opening of the oviduct is situated between the largest or third pair of legs. No males were observed. In a species of *Acarus* (*Tyroglyphus*), somewhat like the Cheese-mite, which we have alive at the time of writing, in a box containing the remains of a *Lucanus* larva, which they seem to have consumed, as both young and old are swarming there by myriads, the young are oval and like the adults, except that they are six-legged, the fourth pair growing out after a succeeding moult.

Such is a brief summary of what has been generally

known regarding the metamorphoses of a few species of mites. But a French naturalist, C. Robin, has recently observed in certain bird sarcoptids, to which the parasite of the Downy Woodpecker noticed above is allied, a still "more complicated series of phenomena; in these the males pass through four, and the females through five stages, indicated as follows: (1) the *egg*, on issuing from which the animal has the form of (2) a *hexapod larva*, followed by the stage of (3) *octopod nymphæ* [four-footed pupæ], without sexual organs. (4) From some of these nymphæ issue: *a*, *sexual males*, after a moult which is final for them; *b*, from others issue *females without external sexual organs*, resembling the nymphæ, but larger, and in some species furnished with special copulatory organs. Finally, after a last moult following copulation, these females produce (5) the *sexual and fecundated females*, which do not copulate, and in the ovary of which eggs are to be seen. No moult follows that which produces males or females furnished with sexual organs; but previously to this the moults are more numerous than the changes of condition." "The larvæ undergo from two to three moults before passing to the state of nymphæ." These latter also undergo two or three moults. (Annals and Magazine of Natural History, 1868, p. 78.)

In some other species of mites no males have been found, and the females have been isolated after being hatched, and yet have been known to lay eggs, which produced young without the interposition of the males. This parthenogenesis has been noticed in several species.

With their rapid increase in numbers these insects often suddenly appear in vast numbers on various articles of food, and about houses, so as to be very annoying. Mr. J. H. Gregory, of Marblehead, Mass., has found the mite figured on plate 6, fig. 6 (magnified 60 diameters), very injurious to the seeds of the cabbage, which it sucked dry. This is an interesting form and appears to belong to the genus *Cheyltus*. It is of medium size, and especially noticeable from

the tripartite palpi, which are divided into an outer, long, curved, clawlike lobe, with two rounded teeth at the base, and two inner, slender lobes pectinated on the inner side, the third innermost lobe being minute. The beak terminates in a sharp blade-like point.

We will now give a hasty glance at the different groups of mites, pausing to note those most interesting from their habits or relation to man.

The most highly organized mite (and by its structure most closely allied to the spider) is the little red garden mite, belonging to the genus *Trombidium*, to which the genus *Tetranychus* is also nearly related. Our own species of the former genus have not been "worked up," or in other words identified and described, so that whether the European *T. holosericeum* Linn. is our species or not, we cannot tell. The larvæ of this and similar species are known in Europe to live parasitically upon Harvest-men (*Phalangium*), often called Daddy-long-legs; and upon Aphides and other insects. The European *Tetranychus telarius* Linn., or web-making mite, spins large webs on the leaves of the linden tree. Then succeed in the natural order the water mites, *Hydrachna*, which may be seen running over submerged sticks and on plants, mostly in fresh water, and rarely on the borders of the sea. The young, after leaving the eggs, differ remarkably from the adults, so as to have been referred to a distinct genus (*Achlysia*) by the great French naturalist, Audouin. They live as parasites on various water insects, such as *Dytiscus*, *Nepa* and *Hydrometra*, and when mature live free in the water, though Von Baer observed an adult *Hydrachna concharum* living parasitically on the gills of the fresh-water mussel, *Anodon*. The species are of minute size.

Collectors of beetles often meet with a species of *Uropoda* attached firmly to their specimens of dung-inhabiting or carrion beetles. It is a smoothly polished, round, flattened mite, with short, thick legs, scarcely reaching beyond

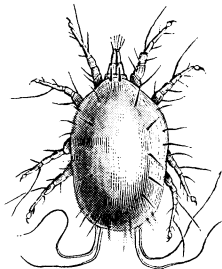
the body. We now come to the Ticks, which comprise the largest mites. The genus *Argas* closely resembles *Ixodes*. Gerstaecker states that the *Argas Persicus* is very annoying to travellers in Persia. The habits of the wood ticks, *Ixodes*, have been already referred to in the NATURALIST (Vols. ii, p. 559 ; iii, p. 51). Travellers in the tropics speak of the intolerable torment occasioned by these pests, which, occurring ordinarily on shrubs and trees, attach themselves to all sorts of reptiles, beasts and cattle, and even man himself as he passes by within their reach. Sometimes cases fall within the practice of the physician, who is called to remove the tick which is found sometimes literally buried under the skin. Mr. J. Stauffer writes me, that "on June 23d the daughter of Abraham Jackson (colored), playing among the leaves in a wood, near Springville, Lancaster County, Penn., on her return home complained of pain in the arm. No attention was paid to it till the next day, when a raised tumor was noticed, a small portion protruding through the skin, apparently like a splinter of wood. The child was taken to Dr. Morency, who applied the forceps, and after considerable pain to the child, and labor to himself, extracted a species of *Ixodes*, nearly one-quarter of an inch long, and of an oval form and brown mahogany color, with a metallic spot, like silver bronze, centrally on the dorsal region." This tick proved, from Mr. Stauffer's figures, to be, without doubt, *Ixodes unipunctata* Pack. (Pl. 6, fig. 11, enlarged). It has also been found in Massachusetts by Mr. F. G. Sanborn.

Another species is the *Ixodes bovis* Riley (Pl. 6, fig. 10), the common cattle tick of the Western States and Central America. It is very annoying to horned cattle, gorging itself with their blood, but is by no means confined to them alone, as it lives indifferently upon the rattlesnake, the iguana, small mammals, and undoubtedly any other animal that brushes by its lurking-place in the forest. It is a reddish, coriaceous, flattened, seed-like creature, with the body

oblong oval, and contracted just behind the middle. When fully grown it measures from a quarter to half an inch in length. We have received it from Missouri, at the hands of Mr. Riley, and Mr. J. A. McNiell has found it very abundantly on horned cattle on the western coast of Nicaragua. We now come to the genus *Acarus* (*Tyroglyphus*), of which the cheese and sugar mites are examples. These, and their allied forms, are among the most lowly organized of the Arachnids, and seem to connect the spiders with the Crustacea, the sea-spiders (*Pycnogonids*) bearing a remarkable resemblance to certain mites. Some species of Acarian mites have been found in the lungs and blood-vessels, and even the intestinal canal of certain vertebrates, while the too familiar itch insect lurks under the skin of the hand and other parts of the body of uncleanly human bipeds.

Many people have been startled by statements in newspapers and more authoritative sources, as to the immense numbers of mites (*Acarus sacchari*, fig. 63) found in unrefined or raw sugar. According to Prof. Cameron, of Dublin, as quoted in the "Journal of the Franklin Institute," for November, 1868, "Dr. Hassel (who was the first to notice their general occurrence in the raw sugar sold in London) found them in a living state in no fewer than sixty-nine out of seventy-two samples. He did not detect them in a single specimen of refined sugar. In an inferior sample of raw sugar, examined in Dublin by Mr. Cameron, he reports finding five hundred mites in ten grains of sugar, so that in a pound's weight occurred one hundred thousand of these little creatures, which seem to have devoted themselves with a martyr-like zeal to the adulteration of sugar. They appear as white specks in the sugar. The disease known as grocer's itch is, undoubtedly, due to the presence of this mite, which, like its ally the *Sarcoptes*, works its way under the

Fig. 63.



skin of the hand, in this case, however, of cleanly persons. Mr. Cameron states that "the kind of sugar which is both healthful and economical, is the dry, large-grained, and light-colored variety."

Closely allied to the preceding, is the Cheese-mite (*Acarus siro* Linn.), which often abounds in newly made cheese. Lyonet states that during summer this mite is viviparous. *Acarus farinæ* DeGeer, as its name indicates, is found in flour. Other species have been known to occur in ulcers.

The itch insect (*Sarcoptes scabiei* DeGeer, Pl. 6, fig. 7) was first recognized by an Arabian author of the twelfth century, as the cause of the disease which results from its attacks. The body of the insect is rounded, with the two hind pair of feet rudimentary and bearing long hairs. It buries itself in the skin on the more protected parts of the body, and by its punctures maintains a constant irritation.

Fig. 64. Other species are known to infest the sheep and dog.



Another singular mite is the *Demodex folliculorum* (Fig. 64), which was discovered by Dr. Simon, of Berlin, buried in the diseased follicles of the wings of the nose in man. It is a long slender worm-like form, with eight short legs, and in the larva state has six legs. This singular form is the lowest and most degraded of the order of Arachnids. We figure on plate 6, figs. 8 and 9, greatly enlarged, a most singular mite, discovered by Newport on the body of a larva of a wild bee, and described by him under the name of *Heteropus ventricosus*. Fig. 8, in the plate, represents the body of the fully formed female. After attaining this form, its small abdomen begins to enlarge until it assumes a globular form (Fig. 9), and the mass of mites look like little beads. Mr. Newport was unable to discover the male, and thought that this mite was parthenogenous. It will be seen that the adult *Demodex* retains the elongated, worm-like appearance of the larva of the higher mites, such as *Typhlodromus*. This is an indication of its low rank, and hints of a relation-

ship to the Tardigrades and the Pentastoma, the latter being a degraded worm, living parasitically within the bodies of other animals.

EXPLANATION OF PLATE VI.

- Fig. 1. Larva of a bird mite, *Dermaleichus*.
 Fig. 2. Pupa (?) of the same.
 Fig. 3. Adult female of the same.
 Fig. 4. Larva of *Typhlodromus pyri* Scheuten. (From Scheuten.)
 Fig. 5. Larva of another species of *Typhlodromus*. “ “
 Fig. 6. *Chelytus* (probably undescribed).
 Fig. 7. *Sarcoptes scabiei* DeGeer. (From Gervais.)
 Fig. 8. *Heteropus ventricosus* Newport, fully-formed female. (From Newport.)
 Fig. 9. *Heteropus ventricosus* Newport, gravid female. (From Newport.)
 Fig. 10. *Ixodes bovis* Riley.
 Fig. 11. *Ixodes unipunctata* Packard.



THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.



(Continued from page 212.)

THE question is often asked what kinds of plants are the best for the aquarium, and where are they found? Most writers on this subject give long lists of plants, which are useless to those who are unacquainted with the botanical names. To the majority of people not even the common names of most water plants are known, and to such it becomes very perplexing to make a selection from a list bare of any description. Although it is insisted by some that the tank should not be filled with every kind of plant that the collector can obtain, yet it seems as if there was no sound reason why all the plants that flourish in the aquarium should not be placed therein. In a properly managed aquarium there are very few water plants which will not do well; the few exceptions being found in the lilies, which require a